MASTER OPERATIONS PLAN

LEICHNER LANDFILL
CLARK COUNTY, WASHINGTON

Prepared for

Leichner Brothers Land Reclamation Corp.

April 2005

Prepared by

EMCON/OWT, Inc.
10300 SW Nimbus Ave., Suite B
Portland, Oregon 97223

Project 822351

EMCON/OWT, Inc.
10300 SW Nimbus Avenue
Suite B
Portland, OR 97223-4345
503.603.1000
Fax: 503.603.1001

Shaw® EMCON/OWT, Inc.

April 27, 2005
Project 822351

Mr. Craig Leichner
Leichner Brothers Land Reclamation Corporation
PO Box 820588
Vancouver, Washington 98682-0013

Re: Master Operations Plan

Dear Craig:

EMCON/OWT, Inc. is pleased to submit this updated Master Operations Plan for the Leichner Brothers Landfill. This document provides guidance to you and your operations staff during the closure period of the site in accordance with the Washington Department of Ecology Minimum Functional Standards.

If you have any questions or require any further information, please do not hesitate to contact me at (503) 603-1063.

Sincerely,

EMCON/OWT, Inc.

Don Hullings
Project Manager

Michael Kehano
Project Engineer

cc: Gary Bickett, SWWHD
Yvonne VanNostran, SWWHD

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1 INTRODUCTION

Leichner Brothers Land Reclamation Corporation (LBLRC) operates the Leichner Brothers Landfill in Clark County, Washington. Leichner Landfill is a closed 70-acre municipal solid waste landfill. The landfill operated from the late 1930's until 1991. All of the landfilled area has received final closure with an engineered composite cap, a landfill gas control and recovery system, and a storm water control system. Landfill closure occurred in phases during the summer seasons of 1989, 1990, 1991, and 1992. A consent decree, including a cleanup action plan, which established groundwater compliance standards, was completed in June 1996.

The intent of the Leichner Brothers Landfill Master Operations Plan is to provide an integrated approach during the post closure of the landfill in an economical and environmentally sound manner, in compliance with the Minimum Functional Standards (MFS) for Solid Waste Handling. The Master Operations Plan is a working document, which should be readily accessible to landfill personnel and should be maintained and updated throughout the active life and post-closure period of the landfill.

EMCON/OWT, Inc. (EMCON) has prepared this plan for the exclusive use of LBLRC and their agents, for specific application to the Leichner Brothers Landfill site, in accordance with generally accepted engineering practices.

2 SITE CONDITIONS

2.1 LOCATION AND ACCESS

The Leichner Brothers Landfill is located in southern Clark County, Washington, within Section 4, T2N, R2E, WM., as shown on Figure 1. The site is approximately six miles northeast of the City of Vancouver and one mile East of the Interstate 205 and the N.E. 84th Street interchange.

To access the site from Interstate 205, take exit number 32 – Padden Parkway – East and travel east on N.E. Padden Parkway. From N.E. Padden Parkway, proceed north on N.E. 94th Avenue to the site entrance at 9411 N.E. 94th Avenue. All roads to the site from Interstate 205 are maintained, asphalt-paved roads, which provide continuous, all weather access to the site.

2.2 PAST AND CURRENT OPERATIONS

Landfilling activities at the site started in 1939 for reclamation of previously quarried areas which produced sand and gravel for local road construction. As was the practice at most landfills throughout the country, refuse deposited at the Leichner Brothers Landfill was routinely burned until 1962 when the first MFS were introduced.

The landfill, like all sites of its vintage, was not lined prior to refuse placement, and thus no leachate handling facilities exist at the site. Since the entire permitted footprint was filled with refuse, bottom liners were not installed at the site.

The landfill operation became one of the first in the state to use a steel wheeled compactor to increase waste density within the landfill, thereby improving operating efficiency and extending the landfill life. To further improve operating efficiency a waste shredder was installed at the site in 1971. This shredder was used until 1975 when it was determined that shredding waste was not cost effective due to high operating and maintenance costs.

In 1974, an Operations Plan and an Environmental Impact Statement (EIS) were prepared. In 1978, landfill gas was found to be migrating off-site along the eastern boundary of the landfill. In response to this problem, an active landfill gas migration control system was installed between the refuse limits and the property line. A system remains in operation and continues to perform its intended function. In 1979, a new EIS was prepared to allow permitting of the site and continued operation. In 1984, a Final Closure Plan was prepared for the site by Cooper

Consultants, Inc. This plan provided details for final grades and the final landfill cover, as well as estimates of remaining site life. The Final Closure Plan was supplemented in 1986 by a second report prepared by Cooper Consultants, Inc.

Approximately 65 acres received final closure with an engineered composite cap and a landfill gas control/recovery system. The composite final cover consists of a 60-mil high density polyethylene (HDPE) geomembrane covered by a 1-foot-thick drainage layer, geotextile filter, and 16-inches of topsoil. The final cover system is designed to reduce infiltration of stormwater into the landfill, to prevent potential contamination of stormwater, to provide positive drainage of the landfill surface, and to contain landfill gas.

The facility retains an NPDES permit to discharge stormwater captured in the stormwater collection system. The stormwater collection system has operated continuously since 1995. The stormwater collection system currently operates in partial fulfillment of the July 17, 1996 Consent Decree between Ecology and LBLRC, and with Washington Administrative Code (WAC) WAC 173-~~340~~-410 and 173-~~340~~-820.
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2.3 CLIMATE

Climate at the site is generally described as marine-type with mild, wet winters and warm, humid summers. Major geographic influences on the climate in the site area are the Pacific Ocean, Cascade Mountain Range, and the Columbia River Gorge. Temperature and rainfall conditions are generally controlled by the Pacific Ocean and Cascade Mountains and wind conditions are generally controlled by the exchange of air between eastern and western Washington through the Columbia River Gorge.

The average annual temperature recorded at nearby Vancouver, Washington is 52.4°F. The maximum average monthly temperature of 79.1°F occurs in August and the minimum average monthly temperature, 32.4°F, occurs in January.

Rainfall occurs throughout the year with 75% of the average annual 39-inches recorded in Vancouver falling during the six-month period between October and March. The maximum monthly average, 6.31-inches, occurs in December with the minimum monthly average, 0.61-inch, occurring in July.

2.4 HYDROLOGY

Topography around the landfill site consists of a mildly sloping valley floor separating the Coast Range and Cascade Mountains. Surface runoff in the site vicinity generally flow to the southwest at a gradient of approximately 2-percent. The nearest surface water body to the site is Curtin Creek of Salmon Creek approximately 0.6 miles west of the site. The site is not subject to inundation due to flooding.

2.5 HYDROGEOLOGIC SETTING

In general, the site is underlain by Pleistocene Alluvium and Pliocene Troutdale Formation. The alluvium is part of a deltaic fan deposited by the Columbia River near the western end of the Columbia Gorge. Coarse-grained material was deposited near the mouth of the gorge and finer-grained material was deposited further downstream. The alluvium encountered in the site area consisted primarily of unconsolidated sand and gravel which are occasionally silty and clayey. In general, the sand becomes finer grained with depth.

The Pliocene Troutdale formation was deposited as part of a large piedmont fan along the western flank of the Cascade Mountain range. The formation is composed of a lower and upper member. The lower member is predominantly fine-grained material while the upper member consists of sand and gravel which is frequently weakly to moderately cemented. The upper portion of the upper Troutdale member is usually weathered to clay, clayey sand, and silt.

The upper Troutdale material encountered at the site is predominantly gravel and sand with a fine-grained sand and silt matrix. The gravel was occasionally weakly to moderately cemented, but was frequently uncemented. No area-wide impermeable zones were observed at the site. The depth from ground surface to the top of the upper Troutdale range from 78- to 102-feet. The top of the formation dips approximately 8-feet per 1000-feet to the southwest.

Annual data indicates groundwater in the Pleistocene Alluvium flows in a southwesterly direction. The groundwater flow gradient in the deeper aquifer flows in a more southerly direction, based on information collected during annual groundwater level measurements. Water levels in wells completed in the deeper system are consistently lower than those in the shallow system, but above the contact between the Pleistocene alluvium and Troutdale formation.

2.6 GEOLOGIC ACTIVITY

No significant geologic activity is anticipated near the Leichner Brothers Landfill. Review of available literature indicates that no known holocene faults exist in Clark County. Although the possibility for regional volcanic activity exists as demonstrated by the 1980 Mount St. Helens eruption, no significant environmental damage is anticipated at the landfill as a result of volcanic eruption.

3 DESIGN AND CONSTRUCTION

3.1 FINAL COVER SYSTEM

Copies of the Phase I and Phase II as-built record drawings are included in Appendix A of this plan.

3.1.1 Construction of Final Cover System

The Leichner Landfill refuse area (approximately 65 acres) was closed in three stages:

- Phase I Closure: In 1988 and 1989, a final cover system was constructed over the north 22 acres of the landfill.
- Phase IIA Closure: In 1991, a final cover system was constructed over 22 of the remaining 43 acres of the landfill. Construction was performed in the southeast portion of the Phase II closure area.
- Phase IIB Closure: In 1992, the remaining 21 acres were closed and capped off with a final cover system.

All three closures were constructed to meet the applicable requirements specified in the MFS, Chapter 173-304 WAC.

3.1.2 Final Cover System Description

The final cover system is a multi-layered composite system covering the entire 65 acres of refuse placed at the landfill. The final cover consists of (from bottom to top) general earthfill, select earthfill, a flexible membrane liner (FML), a drainage layer, geotextile, vegetative soil, topsoil, and native grasses. During Phase II final cover construction (i.e., the south 43 acres of the landfill), an underdrain system was constructed within the drainage layer. The underdrain system outlets to the perimeter ditches around the landfill. The final cover components and their purposes are described below.

3.1.2.1 General Earthfill

General earthfill was placed over landfill areas as needed to provide a firm foundation for the other components of the final cover system and to construct positive drainage across the landfill by filling depressions and smoothing out the existing grade.

General earthfill was compacted in lifts no more than one-foot thick, then finish graded to match design subgrade elevations. During Phase IIB construction, soil and burned refuse were used together as general earthfill. The soil and burned refuse mixture (consisting mostly of soil, rock, ash, and glass, with minor amounts of metal) was obtained from an abandoned refuse-burning area located south of the closed landfill.

3.1.2.2 Select Earthfill

Select earthfill was placed over the general earthfill to provide a protective soil layer underneath the flexible membrane liner.

The select earthfill consists of screened soil with a maximum particle size of one-inch. Gravel-size materials in the select earthfill were rounded. In the Phase I closure area, select earthfill was placed in a 6-inch-thick layer over the general earthfill and finish-graded with a steel drum roller. In the Phase IIA and 11B closure areas, the select earthfill thickness was reduced to 4 inches.

3.1.2.3 Flexible Membrane Liner (FML)

The FML, frequently referred to as the geomembrane, is a low permeability barrier, which contains landfill gas and separates surface water from leachate.

A 60-mil thick, high density, polyethylene (HDPE) flexible membrane liner panel or sheet was placed directly over the select earthfill. Both textured and smooth FML panels were installed. The installation process consisted of unrolling the sheeting, cutting panels to the required dimensions, and welding the seams immediately thereafter. The FML seams were welded primarily by using the hot wedge welding process; however, the extrusion welding process was used when the hot wedge welder could not be used. Examples of extrusion welding include patching, connecting intersecting seams, making small repairs, and in areas with limited accessibility.

Following installation and seam welding, each weld was visually inspected and subjected to both nondestructive and destructive testing. Nondestructive testing consisted of airpressure testing hot wedge welds and vacuum-box testing extrusion welds. Destructive testing consisted of performing shear and peel tests on samples of the welded seams.

3.1.2.4 Drainage Layer

A 12-inch-thick, drainage layer, consisting of free-draining sand, was placed directly over the 60-mil HDPE liner. Rainfall, which infiltrates through the cover soil, drains vertically through the drainage layer, then laterally along the surface of the FML. The water is collected by a system of underdrain pipes which outlet to surface ditches.

3.1.2.5 Geotextile

The geotextile provides a filtering medium between the drainage layer and the overlying vegetative soil. This medium protects the drainage layer from clogging by keeping fine vegetative soil particles out of it.

Nonwoven geotextile was placed over the top of the drainage layer. The geotextile was deployed in much the same orientation as the FML, as shown on the FML as-built panel layout drawings. The geotextile was overlapped at least 6 inches, and the seams were either continuously sewn, using polymeric thread, or heat-bonded.

3.1.2.6 Vegetative Soil

Vegetative soil was placed in an 8-inch-thick layer directly over the nonwoven geotextile. The vegetative soil provides a rooting medium underneath the topsoil and a protective soil layer over the top of the drainage layer and geotextile.

3.1.2.7 Topsoil

Topsoil provides a soil layer for grassy vegetation. During Phases I and IIA, imported topsoil was placed directly over the vegetative layer in two, 4-inch-thick lifts. The first lift was mixed into the upper 4 inches of the underlying vegetative soil before placement of the second 4-inch thick lift of topsoil.

During Phase IIB construction, an on-site soil source was used. The soil source met the requirements of both vegetative soil and topsoil. Because the materials met the specified requirements of both materials, it was unnecessary to place the soil materials in separate lifts or to mix the lifts together. The vegetative soil and topsoil mixture was placed in a single, 16-inch-thick lift on top of the geotextile.

3.1.2.8 Hydroseed

Hydroseeding provides a grassy ground cover over the entire closed landfill surface and any other soil surfaces disturbed by construction. The hydroseeding reduces erosion of the soil surfaces and provides an aesthetically pleasing finished appearance.

The performance of the hydroseed mix used in Phases I and IIA construction was fair, but it was thought that some improvement could be made. Therefore, a new design mix was used in Phase IIB construction.

3.2 STORMWATER SYSTEM

During 1988 and 1989, LBLRC completed construction of a storm water collection, impoundment, and pumped-discharge system for surface water drainage on closed parts of the landfill. Final closure of the landfill was completed in October of 1992. Figure 4 shows the site's storm water system, which provides drainage for approximately 70 acres of capped fill. Storm water is conveyed to a detention basin located on the north end of the landfill and then pumped to Curtin Creek through a pump station located at the west end of the basin. The pump(s) are automatically activated to discharge storm water depending on the water level in the basin.

3.2.1 Purpose of Stormwater System

The stormwater system is designed to minimize erosion, prevent contamination of stormwater, prevent ponding of water on the landfill, control the rate of stormwater discharge, and minimize the discharge of suspended solids.

3.2.2 Construction of Stormwater System

The stormwater system was constructed concurrent with the closure of the landfill. Improvements to the stormwater system were constructed in 1996. The following provides a summary of the construction efforts.

- **Stormwater Outfall Construction:** In 1988, the force main and outfall for the north detention basin were constructed. This construction included approximately 240 feet of 20-inch-diameter force main, 3,500 feet of 24-inch-diameter gravity drain, and 650 feet of open ditch which outlets into Curtin Creek. The stormwater system was constructed in accordance with the Stormwater Outfall construction drawings (Sweet-Edwards/EMCON, Inc., September 1988).

- **Phase I Closure:** In 1988 and 1989, a final cover system was constructed over the northern 22 acres of the landfill. The closure included construction of the north detention basin, the pump station, and sideslope and perimeter ditches (Ditch Types 1 and 2). The stormwater system was constructed in accordance with the *Stormwater Runoff Control Plan* (Sweet-Edwards/EMCON, Inc., August 1987), and the Modules 1B, 2 and 3 Closure construction drawings (Sweet-Edwards/EMCON, Inc., August 1988).

- **1990 Stormwater System Improvements:** In 1990, stormwater system improvements included the addition of several sideslope ditches (Ditch Type 5) shown as existing ditches on Phase II construction Drawings Nos. 3, 4, and 5 (see Appendix A).

- **Phase II Closure:** In 1991 and 1992, a final cover system was constructed over the remaining 43 acres of the landfill. The closure included construction of the west drainage basin and pumping station, the sedimentation basin, the 18-inch-diameter stormwater conveyance pipe located around the west and north perimeter of the north detention basin, and numerous ditches.

- **1996 Stormwater System Improvements:** In 1996, additional pumping capacity was added at the west drainage basin to relieve flooding associated with high intensity storm events. These improvements included the addition of a third submersible pump at the west drainage basin pump station, the installation of a second force main, and extension of the 24-inch-diameter stormwater conveyance pipe.

3.2.3 Stormwater System Description

The stormwater system consists of five main components: the collection system, the west drainage basin and pump station, the sedimentation basin, the north detention basin, and the off-site conveyance system (see Figure 4). Stormwater is collected using underdrains, cutoff ditches, perimeter ditches, and catch basins. Collected stormwater is routed to either the 1-acre west drainage basin or to the 1-acre sedimentation basin. The west detention basin receives surface water from the south and west portions of the landfill (approximately 35 acres). The sedimentation basin receives surface water runoff from the north portion of the landfill (approximately 30 acres). Stormwater entering the west drainage basin is pumped to the sedimentation basin using two 8-inch-diameter force mains. In this manner, all runoff from the site is routed to the sedimentation basin for suspended solids removal. Stormwater exits the sedimentation basin into the east end of the 3.4-acre north detention basin. The detention basin controls the release of stormwater runoff from the landfill by retaining the 25-year, 24-hour storm. Stormwater is pumped from the detention basin to Curtin Creek at a maximum release rate of 8.5 cubic feet per second by means of a pump station located at the west end of the basin. Stormwater pumped from the north detention basin is routed through approximately 240 feet of 20-inch-diameter force main, 3,500 feet of 24-inch-diameter gravity storm drainpipe, and 650 feet of grass-lined ditch which outlets into Curtin Creek. The stormwater system is described further in the following sections.

3.2.3.1 Collection System

Stormwater is collected using underdrains, cutoff ditches, perimeter ditches, and catch basins. The underdrain system collects infiltrating rainfall within the drainage layer of the final cover and routes it to perimeter ditches. Numerous types of sideslope and perimeter ditches were constructed during landfill closure. Phase I ditches are prefixed with a "1" (i.e., 1-1, 1-2, etc.) and Phase II ditches are prefixed with a "2" (i.e., 2-1, 2-2, etc.). Areas outside of the landfill cover are serviced by ditches where possible. In the facilities area, west of the landfill, catch basins are utilized to collect stormwater.

The following sections further describe the collection system.

Underdrain System. The underdrain system consists of perforated, 4-inch-diameter polyethylene pipe installed in the drainage layer (above the geomembrane) of the landfill cover. Surface water infiltrating the cover soil is collected in the underdrain pipes. The pipes are placed in shallow troughs, depressions in the geomembrane, or under the flow lines of Ditch Type 1-1. As the water moves across the geomembrane, it is trapped by the underdrain troughs, collects in the polyethylene pipe, and ultimately discharges into perimeter ditches. In the Phase II closure area, underdrain pipes generally are spaced approximately 120 feet apart and are inclined at an approximate 3 to 5 percent slope. The Phase II as-built record drawings show the underdrain locations and details. In Phase I, a similar spacing was constructed for the 1989 closure area. Drawing 4, Phase II and Drawing 7, Phase I show the underdrain pipe locations in Appendix A.

Sideslope Ditches. Sideslope ditches collect and convey surface runoff (i.e., sheet flow) to the perimeter ditches. Sideslope ditches minimize the formation of gullies, caused by sheet flow runoff eroding the landfill's sideslopes. There are three ditch types used as sideslope ditches at the landfill: Ditch Types 1-1, 2-3, and 2-5.

<u>Ditch Type 1-1</u> is a 15-foot-wide, 2.5-foot-deep, V-ditch. It is lined with quarry spalls which are placed over a geotextile. The geotextile overlies the drainage layer which is placed on top of the geomembrane liner. The geomembrane liner is part of the final cover section. A perforated 6-inch-diameter underdrain pipe is located directly above the geomembrane liner at the ditch flowline. This ditch type appears throughout the Phase I closure area as sideslope and also as perimeter ditches. (See Appendix A, Detail 2, Drawing 3, Phase I.)

<u>Ditch Type 2-3</u> is a 1-foot-deep, grass-lined, V-ditch lined with a 6-foot-wide erosion control mat. The ditch was constructed by placing a topsoil berm on the downslope side of the ditch flow line, then installing the mat in the ditch flow line. The maximum slope on this ditch is 2 percent. (See Appendix A, Section E, Drawing 7, Phase II.)

<u>Ditch Type 2-5</u> is a 7.5-foot-wide, 10-inch-deep, rock-lined V-ditch constructed on top of a geotextile which cushions an underlying geomembrane liner. The geomembrane ditch liner is not part of the final cover section. It was placed a minimum of 6 inches above the final cover system's geomembrane liner. The purpose of the ditch liner is to prevent surface water from infiltrating into the drainage layer. The ditch was constructed by excavating into the final cover topsoil and vegetative layer, placing the excavated soil as a berm on the downslope side of the ditch, and then lining the ditch with geomembrane. (See Appendix A, Section F, Drawing 7, Phase II.)

Although shown on the Phase II construction drawings, portions of this ditch type were constructed in 1990, 1 year before Phase II construction. The ditches were constructed on the existing Phase I final cover. One of the Type 2-5 ditches collects stormwater discharging from one of the two west drainage basin force mains and conveys it to the sedimentation basin.

Perimeter Ditches. Perimeter ditches convey runoff from the sideslope ditches and the underdrain system either to the west drainage basin or to the sedimentation basin. Perimeter ditches located around the toe of the refuse area also collect sheet flow from the landfill's sideslopes, similar to the sideslope ditch collection system. There are six types of perimeter ditches used at the landfill: Ditch Types 1-1, 1-2, 2-1, 2-2, 2-3 (modified), and 2-4.

Ditch Type 1-1, described above, is a sideslope ditch. This ditch type also appears as a perimeter ditch routing stormwater runoff to the north detention basin. (See Appendix A, Detail 2, Drawing 3. Phase I.)

Ditch Type 1-2 is a 5-foot, 4-inch-wide, 1-foot, 4-inch-deep, grass-lined V-ditch. This ditch type is constructed around the perimeter of the west lobe of the landfill, just outside the limit of the final cover. (See Appendix A, Detail 3, Drawing 3, Phase I.)

Ditch Type 2-1 is a 9-foot-wide, 1.5-foot-deep, rock-lined V-ditch. The rock is placed on top of a geotextile which cushions an underlying geomembrane liner. The geomembrane liner is part of the final cover section. This roadside ditch is constructed between the landfill and the perimeter road located along the west side of the Phase II closure. The final cover underdrain system outlets into this roadside ditch. Ditch Type 2-1 transitions into a Ditch Type 2-4 as it approaches the west drainage basin. (See Appendix A, Section A, Drawing 7, Phase II.)

Ditch Type 2-2 is a 6-foot-wide, 1.5-foot-deep, rock-lined, V-ditch constructed over a geotextile cushion which protects an underlying geomembrane liner. The geomembrane liner is part of the final cover section. This roadside ditch is located along the east and south perimeter of the Phase II closure area. The final cover underdrain system outlets into this roadside ditch. (See Appendix A, Section C, Drawing 7, Phase II).

Modified Ditch Type 2-3 is similar to Ditch Type 2-3 except that the surface of the Modified Ditch Type 3 is rock-lined. The ditch is formed where the final cover meets the landfill maintenance road embankment. The embankment forms the down-slope portion of the ditch.

Ditch Type 2-4 is a 9-foot-wide, 1.5-foot-deep, rock-lined, V-ditch constructed over a geotextile cushion which protects an underlying geomembrane liner. The geomembrane liner is part of the final cover section. This ditch connects Ditch Type 2-1 to the west drainage basin. (See Appendix A, Section C, Drawing 8, Phase II).

Culverts. Five culverts were installed to convey runoff underneath roadways. Two 18-inch-diameter, high density polyethylene (HDPE) culverts convey stormwater runoff under the

Facilities Access Road. These culverts each discharge into a Ditch Type 2-4, located near the west drainage basin. The remaining three culverts are 12-inch-diameter, HDPE. Two convey runoff under the maintenance road located at the north end of the 1992 closure area. The third conveys runoff under the perimeter road near the north landfill gas flare. The runoff flows north through a Ditch Type 1-1 into the drop inlet located west of the north detention basin and flows to the sediment basin through the stormwater conveyance pipe.

Facilities Area Drainage System. Nine catch basins are present in the facilities area located west of the landfill (see Appendix A, Drawing No. 8, Phase I). The catch basins are connected to piping which drains to the west drainage basin (see Appendix A, Drawing Nos. 9 and 17, Phase II).

Northwest Area Drainage System. Stormwater falling on the Module 1B (Phase I) closure area is routed via sideslope and perimeter ditches to a concrete drainage inlet (Type 1) located south of the former north flare station. The drainage inlet is connected to the 18-inch-diameter stormwater conveyance pipe, which drains to the sedimentation basin. Details of the system are shown on Phase II Drawing Nos. 19, 20, and 21 and on the 1996 stormwater system improvement drawing (see Appendix A).

3.2.3.2 West Drainage Basin and Pumping Station

The 1-acre west drainage basin collects runoff from the south and west portions of the landfill (approximately 35 acres). The basin is lined with Gundseal, textured geomembrane, a geotextile cushion, and a 1-foot-thick layer of erosion protection rock (see Appendix A, Phase II Drawing Nos. 8 and 17).

Stormwater is pumped from the west detention basin to the sedimentation basin via a pump station and two 8-inch-diameter force mains. The pump station consists of a precast concrete vault containing two 10-hp and one 22-hp submersible pumps. The two 10-hp pumps are connected to approximately 1,000 feet of force main which discharges to a Type 2-5 ditch located on the north central part of the Phase I closure (see Appendix A). The 22-hp pump is connected to a second 8-inch-diameter force main, approximately 1,100 feet in length, which discharges to the concrete drainage inlet located south of the north flare station. The drainage inlet is connected to the 18-inch-diameter stormwater conveyance pipe which drains to the sedimentation basin.

The pumps are activated by three mercury float level control switches which are set to operate at low, middle, and high stormwater levels. Under normal conditions, only the 22-hp pump will operate. The pump will turn on when the water level reaches the elevation of the middle level switch and will turn off when the water level is pumped down to the elevation of the low level switch. The two 10-hp pumps will turn on only if the elevation of the high level switch is reached. The 10-hp pumps will also turn off when the water level is pumped down to the elevation of the low level switch. The pumps are capable of moving silt-laden water without causing pump damage.

3.2.4 Sedimentation Basin

The 1-acre sedimentation basin is located immediately east of the north detention basin. The sedimentation basin is designed to settle out particles suspended in the stormwater before the water enters the north detention basin. All collected stormwater runoff from the landfill site is routed through the sedimentation basin.

The sedimentation basin is lined with textured, 60-mil, HDPE geomembrane. The geomembrane liner is covered with a geotextile cushion and a 1-foot depth of general earthfill. The sedimentation basin outlet structure is a 16-inch-diameter, fabricated tee structure set in concrete. The fabricated tee has three 4-inch-diameter holes set 1 foot above the bottom of the basin. As stormwater runoff enters the basin, it fills the basin to a one foot depth before beginning to exit through the 4-inch-diameter holes. The top of the tee structure (located 3.4 feet above the bottom of the basin) acts as an emergency overflow for large storm events or in case the 4-inch-diameter outlet holes become clogged. Sedimentation basin details are shown on Phase II Drawing Nos. 18, 19, 20, and 21 (see Appendix A).

3.2.5 North Detention Basin and Pumping Station

The 3.4-acre north detention basin is a geomembrane-lined basin located at the north end of the landfill. The basin controls the release of stormwater runoff from the site by retaining the 25-year, 24-hour storm and allowing a maximum release rate of 8.5 cubic feet per second (cfs). The north detention basin allows additional sedimentation to occur as the stormwater flows from east to west across the basin.

The north detention basin release structure is a concrete enclosure and pumping station containing three 15 hp turbine pumps. The pump inlets are located near the bottom of the concrete enclosure. Stormwater is pumped into a common, 20-inch-diameter force main which connects to the stormwater outfall.

The pumps are activated by three mercury float level control switches which are set to operate at low, middle, and high stormwater levels. Under normal conditions, only one pump will operate. The first pump will turn on when the water level reaches the elevation of the middle level switch and will turn off when the water level is pumped down to the elevation of the low level switch. The second pump will turn on only if the elevation of the high level switch is reached. The second pump will also turn off when the water level is pumped down to the elevation of the low level switch.

The three pumps are used in rotation so that only two pumps are in service at any one time. As indicated on the pump control panel, the centered drum switch indicates which two pumps will be selected, i.e., 1 & 2, 2 & 3, or 3 & 1. The first number on the drum switch will be the primary pump (first to turn on) at the middle water level. The third (inactive) pump serves as a backup to the first two pumps.

Construction details of the north detention basin and pumping station are shown on Phase I Drawing Nos. 4, 5, and 6 (see Appendix A).

3.2.6 Stormwater Outfall

The stormwater system consists of five main components: the collection system, the west drainage basin and pump station, the sedimentation basin, the north detention basin, and the off-site conveyance system. Stormwater is collected using underdrains, cutoff ditches, perimeter ditches, and catch basins. Collected stormwater is routed to either the 1-acre west drainage basin or to the 1-acre sedimentation basin. The west detention basin receives surface water from the south and west portions of the landfill (approximately 35 acres). The sedimentation basin receives surface water runoff from the north portion of the landfill (approximately 30 acres). Stormwater entering the west drainage basin is pumped to the sedimentation basin using two 8-inch-diameter force mains. In this manner, all runoff from the site is routed to the sedimentation basin for suspended solids removal. Stormwater exits the sedimentation basin into the east end of the 3.4-acre north detention basin. The detention basin controls the release of stormwater runoff from the landfill by retaining the 25-year, 24-hour storm. Stormwater is pumped from the detention basin to Curtin Creek at a maximum release rate of 8.5 cubic feet per second by means of a pump station located at the west end of the basin. Stormwater pumped from the north detention basin is routed through approximately 240 feet of 20-inch-diameter force main, 3,500 feet of 24-inch-diameter gravity storm drainpipe, and 650 feet of grass-lined ditch which outlets into Curtin Creek. The stormwater system is described further in the following sections.

From November 1, 1990 until February 5, 2004, the landfill had been operating under an individual NPDES permit issued by Ecology. To streamline permitting, LBLRC applied for an Industrial General Storm Water Permit that was issued on February 5, 2004 for storm water discharges associated with industrial activities. The general permit requires implementation, or update, of a technology-based Storm Water Pollution Prevention Plan (SWPPP) to eliminate surface water quality standards violations caused by storm water. Best management practices specified in the SWPPP may be modified on the basis of monitoring results to maintain acceptable surface water quality discharges. A specific storm water monitoring program has been developed for the site and is described in the SWPPP.

4 OPERATING PROVISIONS

4.1 REGULATORY CONSIDERATIONS

The landfill is currently operating under the July 17, 1996 Consent Decree between the State of Washington Department of Ecology (Ecology) and Leichner Brothers Land Reclamation Corporation (LBLRC) and WAC 173-340-410 and 173-340-820.

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4.2 FINAL COVER INSPECTION AND MAINTENANCE

4.2.1 Inspections

The landfill final cover system should be inspected monthly to identify any required maintenance activities. The entire site should be walked to identify and document any potential problems with the final cover system. A site inspection should also be conducted during or immediately after significant rainfall events, especially during the rainy months when cover soils become saturated. Identifying potential problems early will reduce the extent and cost of future repairs and ongoing maintenance efforts.

4.2.1.1 Settlement and Depressions

Settlement of the landfill surface will occur naturally over time. Settlement is generally somewhat uniform, but areas of differential settlement (i.e., depressions such as sinkholes) may also occur. Depressions that grow quickly (i.e., in less than one month) indicate a potential landfill fire. For this reason, the entire landfill should be monitored monthly for the appearance of new settlement depressions. In addition, settlement markers may be needed for monitoring of landfill surface settlement.

When a settlement depression is observed, it should first be established whether the depression was created by settlement in the refuse, or whether the problem could be due to a possible landfill fire. A depression visibly increasing in size over a short period of time (i.e., a week or less) usually indicates a landfill fire. Depressions caused by a landfill fire usually appear as fairly uniform, bowl-shaped, dimples. Typically, landfill fires occur in close proximity to, or in areas under the influence of, a landfill gas well. Corrective action should be taken immediately to extinguish landfill fires. After the fire has been extinguished, subsequent repair of the area may be required to provide proper surface water drainage.

Depressions caused by differential settlement may present a surface drainage problem. Any change in the size and shape of these depressions should be monitored and recorded in the landfill logbook, noting if there is adequate slope for drainage of stormwater runoff. Also note any ponded rainwater or swampy soils. Flat spots or sumps with no drainage outlet will require repair.

4.2.1.2 Vegetation and Surface Soils

Vegetation is monitored to ensure that it is thriving and providing thick, uniform coverage of landfill soils. The landfill cap should be inspected monthly for bare patches, areas of sparse vegetation, or large accumulations of moss. Areas of stressed or dead vegetation should also be noted. The most probable causes are poor soil or prolonged drought conditions.

Small, isolated areas of stressed or dead vegetation may result from a hole in the FML. Check these areas for discoloration of soils; smell the soil to determine whether a landfill gas odor exists.

The native grasses required in the hydroseeding specifications and applied during closure construction were selected for their ability to hold soil in place (produce a dense root structure) and to thrive in a landfill environment. Bushes, trees, or colonies of other invading species should be monitored and removed if they are determined to be detrimental to this purpose. Any vegetation other than grasses and ground cover species should be removed so the roots do not damage the cover system FML.

4.2.1.3 Erosion and Surface Drainage

Erosion of surface soils may occur anywhere on the landfill site. Vegetation may hide eroded areas, so a thorough walk-through search of the entire surface of the landfill is necessary to identify erosion damage. A monthly inspection for erosion damage should be conducted.

Erosion generally occurs in the flow direction of stormwater runoff. Over time, this causes the formation of long, narrow gullies perpendicular to the slope. The size and location of the gullies and any other erosion scars should be noted. If an erosion scar or gully originates at what appears to be a seep (i.e., a point where water wells up from below the surface), this should be noted, as it indicates possible blockage of the drainage layer or underdrain system. Positive overland drainage of stormwater runoff into surface ditches and catch basins should occur both on the landfill cap and the area around the landfill. Standing water, swampy soils, dead vegetation, flooding during storm events, or other indications of poor drainage should be noted. Eroded soils may collect as sediment deposits in low lying areas, possibly creating flat spots in ditches or causing flooding in other areas.

4.2.1.4 Vector Control

Vectors that can create potential health hazards and nuisances include mosquitoes, and rodents. Mosquitoes can be controlled by eliminating water ponding on site. During the monthly inspections, note any evidence of ground burrows, which would indicate the presence of rodents. If the quantity of burrows becomes numerous in specific areas, rodent control measures may be required.

4.2.2 Maintenance Procedures.

4.2.2.1 Vegetation and Surface Soils

The vegetation should not be allowed to grow higher than a maximum of 30 inches. A mowing schedule should be developed to ensure that the height of the vegetation is kept under this maximum height. Under normal conditions the grass should be mowed as often as necessary to keep under 6 to 8 inches.

Bare spots or areas with sparse vegetation may have poor soil or poor water retention. If these areas persist, the topsoil should be scarified and reseeded per the Phase H hydroseeding specifications. If the seed does not grow well, it may be necessary to clear the area and place an additional 4-inch lift of new topsoil before reseeding per specifications.

If a hole is suspected in the FML, due to the presence of landfill gas odors or discolored soil, the area should be carefully excavated as necessary to confirm or deny the existence of a hole. If a hole is found, the hole and any other portion of the FML damaged during the excavation should be repaired by extrusion welding and then tested with a vacuum box. The final cover section is then to be reconstructed up to final grade and reseeded as shown on the as-built record drawings. Any hydroseeding should be performed in the late spring (May or early June) or in the early fall (late August or September).

4.2.2.2 Repair of Depressions

Interim repairs to depressions that are deep enough to retain water should be accomplished by constructing a surface water outlet. A surface water outlet could be constructed by excavating a ditch through the final cover section from the bottom of the depression down-slope to a point below the elevation of the lowest point of the depression. Where the excavation depth reached the geotextile or the FML, these materials would be cut, and an additional piece of the material would be placed in the bottom of the excavation as necessary. If the FML were cut, the patch material would be welded to the existing FML. The drained depression would be allowed to settle until primary consolidation was complete or until the surface water outlet was no longer functional, whichever occurs first.

Permanent repair of the cover should be accomplished by excavating the topsoil, vegetative soil cover, and drainage layer to expose the FML in the area of the depression. The exposed FML would be cut around the rim of the depression, and the depression filled with lightweight fill (i.e., hogfuel or cinders) to obtain the minimum required slope for proper drainage. The lightweight fill would be covered with new FML that would be welded to the existing FML. The drainage layer, geotextile, vegetative soil, and topsoil would be replaced over the new section of

FML. The repaired area would then be hydroseeded using the Phase II seeding specifications or equivalent. Interim and permanent repairs of surface depressions would be constructed under the guidance and direction of a registered professional engineer. All construction must be performed in accord with the specifications and details of the original design in the area repaired. The specific areas repaired must be noted and documented along with the quantities of materials used.

4.2.2.3 Vegetation and Surface Soils

The vegetation should not be allowed to grow higher than a maximum of 30 inches. A mowing schedule should be developed to ensure that the height of the vegetation is kept under this maximum height. Under normal conditions the grass should be mowed as often as necessary to keep under 6 to 8 inches.

Bare spots or areas with sparse vegetation may have poor soil or poor water retention. If these areas persist, the topsoil should be scarified and reseeded per the Phase II hydroseeding specifications. If the seed does not grow well, it may be necessary to clear the area and place an additional 4-inch lift of new topsoil before reseeding per specifications.

If a hole is suspected in the FML, due to the presence of landfill gas odors or discolored soil, the area should be carefully excavated as necessary to confirm or deny the existence of a hole. If a hole is found, the hole and any other portion of the FML damaged during the excavation should be repaired by extrusion welding and then tested with a vacuum box. The final cover section is then to be reconstructed up to final grade and reseeded as shown on the as-built record drawings. Any hydroseeding should be performed in the late spring (May or early June) or in the early fall (late August or September).

4.2.2.4 Erosion and Surface Drainage

It is not usually practical to attempt permanent repair of erosion scars or large ponding areas during the rainy season due to saturated soils and poor access to landfill slopes. However, interim repairs should be made in a timely manner, since erosion scars can propagate rather quickly if left unchecked during periods of heavy rainfall.

Interim repairs of washout gullies can be made by placing a series of sediment filtering dams across the gully at regular intervals. For small gullies (i.e., less than 1-foot wide), loose straw is to be lightly compacted into the gully and anchored with hand-placed broken rock at 20-foot intervals. For larger size gullies, or where the small dams fail, larger dams should be constructed by keying them into undisturbed soils underneath and on either side of the gully, then by constructing a hay bale dam. If specific areas continue to erode regularly, they can be rip rapped to prevent erosion.

When the landfill has stabilized to the point where earthmoving equipment can drive onto it, permanent repairs can be made to damaged areas. Once temporary controls are removed, erosion scars should be filled in with clean topsoil, graded for drainage, and then reseeded. Delineate the size of areas repaired and the quantities of materials used to perform the repairs in each area.

Sediment deposits (i.e., eroded soils from up-slope), which negatively impact surface drainage by channeling sheet flow or causing flooding to occur, must be regraded or removed. If removed, the soils may be stockpiled and used as vegetative soil material in the future.

Sediment deposits that do not affect surface drainage can remain in place. If existing vegetation cannot grow through the sediment, the deposit should be covered with 4 inches of topsoil and reseeded.

4.2.2.5 Vector Control

If the quantity of burrows becomes numerous in specific areas, rodent control measures consisting of trapping or poisoning may be required.

4.2.3 Inspection and Maintenance Documentation

Inspection and maintenance activity should be recorded in a logbook, which is kept at the landfill. A copy of inspection and maintenance records should be mailed to the EMCON project manager, where a second file will be maintained. The general maintenance checklist should be used as a guide to monitor, inspect, and document the performance of, and any inadequacies discovered in, the final cover system. Any problems or inadequacies found should be reported to the EMCON project manager. Each completed checklist will be filed at EMCON's office and in the Leichner Landfill logbook.

The logbook provides a written record of all inspection and maintenance activities. Any unusual events such as a landfill gas fire, increased vector problems, unusual storm events, etc., should be noted. The logbook will provide a history of site activities over time and will serve as a resource document for personnel coming on site.

4.3 STORMWATER SYSTEM MAINTENANCE PROCEDURES

4.3.1 Ditches

Remove obstructions, repair or eliminate flat spots, and correct eroded areas by adding rock or appropriate soil materials. Note any standing water due to landfill settlement or silt damming. If silt damming occurs, remove excess silt with a backhoe or manually shovel it clean. If significant landfill settlement occurs, consult the engineer regarding proper actions to be taken.

4.3.2 Culverts

Clean out any debris or accumulations of material from the entrances and exits of all culverts. After cleaning, verify that water is flowing through the culvert.

4.3.3 Catch Basins/Manholes

Remove silt and debris from the inside and outside of all catch basins. Place any removed silt in the south borrow depression area.

4.3.4 West Drainage Basin and Pumping Station

Keep the basin clear of accumulated debris. Remove debris manually as soon as possible (when the water level is low).

Use a rubber-tired front-end loader to remove silt deposits. Do not allow silt to build up to the bottom of the inlet pipe to the pump station vault. When removing silt from within the pumping station vault, treat the vault as a confined space. Check for air deficiencies before entering. Place a ladder in the vault and manually remove silt by using a shovel and bucket. Station someone on top with a rope to raise and empty the bucket.

Pump bearings are prelubricated at the factory and have a design life of 15,000 hours (estimated to be about 10 years with current electrical load and duty cycles). The submersible electric motors are protected by a sensing probe which detects the influx of water and warns of impeding failure. The signal (red indicator light located below the control cabinet) will not shut down the electric motor; it is used to signal that preventative maintenance is required. If the red indicator light is on, the electric motor should be serviced as soon as possible.

4.3.5 Sedimentation Basin

Use a rubber-tired front-end loader to remove silt deposits from the basin. Do not allow silt to build up to the overflow outlet from the basin. Keep the inlet and outlet structures free and clear of obstructions. Remove debris as required.

4.3.6 North Detention Basin

Keep the detention basin clear of accumulated debris. Remove debris manually as soon as possible (when the water level is low).

Use a rubber-tired front-end loader to remove silt deposits. Do not allow silt to build up to the bottom of the inlet pipe to the pump station vault. To remove silt from within the pumping station vault, treat the vault as a confined space. Check for air deficiency before entering. Place a ladder in the vault and manually remove silt by using a shovel and bucket. Station someone on top with a rope to raise and empty the bucket.

Pump and motor maintenance is based upon usage rates and lubrication schedules. Electric motor and turbine pump bearings require lubrication every 2,000 hours of operation or every six months with current duty cycles. Based on these requirements, lubrication is scheduled every six months. Use the following procedure for greasing the equipment:

1. Stop the pump unit.
2. Switch the main pump disconnect switch to "OFF."
3. Remove the relief plug and free the hole of any hardened grease.
4. Wipe the lubrication fitting clean and add grease using a hand-operated grease gun.
5. If pumps can be activated with enough stormwater, leave the grease relief plug off temporarily. Place the pump back on-line by moving the main disconnect switch to "ON." Run the pump manually for 20 minutes to expel excess grease. Then replace the grease plug. If there is not enough stormwater available skip this step, and proceed to step 6 of this procedure.
6. Stop the pump and turn "OFF" the main disconnect switch. Replace the grease plug.
7. Turn "ON" the main disconnect switch; reset the pumps to automatic operations.

Lead-lag pump switching is scheduled to be performed every month to keep the run-hour time for each pump at relatively the same level of usage.

4.4 GAS SYSTEM MAINTENANCE PROCEDURES

The GCCS system contains piping, equipment, and instrumentation that must be periodically inspected and properly maintained to provide optimum and continuous operation. Although the collection system is constructed from relatively durable materials, normal wear and tear does occur due to weathering, landfill movement, and temperature stresses.

The following conditions should be inspected for, and scheduled for repair if required:

- Well heads which have shifted due to landfill or cover movement;
- Well bore backfill which has settled should be backfilled to slightly above grade, and the well bore seal should be adjusted, if required;
- Wells with increasing vacuum requirements, indicating liquid accumulation or other interference with the well casing perforations;
- Abnormal decreases in available pipeline vacuum, indicating a downstream obstruction;
- Pipe alignments which have shifted or pipe supports which have been disturbed;

- Pipe locations with sounds of gurgling or surging water, indicating poor condensate drainage;

- LFG pipe leaks; and

- Missing or open labcock valves or access ports.

The following checklist provides effective measures to prevent conditions that may cause breaks or other emergency failures:

- Transition from wellhead to lateral piping: Any observed stress points and misalignments should be scheduled for correction as soon as possible;

- Wellhead control valves, labcock fittings, and flex hose connections should be replaced when damage is evident;

- Cracks in pipes, fittings, valves, or joints should be repaired immediately; and

- Cracks and depressions that develop on the landfill surface should be filled with soil, compacted, and graded as soon as they appear, to prevent air and water from entering the landfill.

The gas condensate, produced when the warm, moist gas surfaces and travels through the cooler collection pipes and transmission headers, is collected in condensate traps located throughout the landfill. The condensate will be pumped from the traps, using pneumatic pumps, to the flare facility and will be destroyed by incineration. Condensate in header piping can form a blockage in the gas system if it collects in a low point and is not removed from the header system. To maintain positive drainage, a specified slope will be maintained for collection piping on the landfill surface and on the perimeter of the landfill. The aboveground GCCS piping will be adjusted to provide the minimum required slope for correct drainage of the system.

4.5 MONITORING ACTIVITIES

Monitoring activities pertaining to groundwater, surface water and landfill gas will be conducted in compliance with the MFS.

4.5.1 Groundwater Monitoring

Wells are completed in one of two aquifers: the alluvium (shallow or intermediate wells) or the Troutdale Formation (deep wells). Monitoring of Troutdale aquifer wells will occur annually. Two sampling frequencies are proposed for the alluvial aquifer monitoring network:

- Semiannual – Wells LB-1S, LB-5S, LB-6S, LB-10SR, LB-13I, LB-26I, LB-27I; for wells along the perimeter of the property at compliance locations that still demonstrate impacts.

- Annual – Wells LB-3S, LB-4SR, LB-17I, and LB-20S; for wells along the perimeter of the site that typically show background concentrations, for the background well, and for wells along the edge of the waste mass upgradient of the compliance boundary.

The monitoring wells and the parameters will be analyzed as outlined in the CMP. Semiannual sampling will be scheduled for the first and third calendar quarters (typically in the third month of the quarter), which represent periods of seasonal high and low groundwater elevations, respectively. The annual sampling will be scheduled for the first quarter, consistent with historical annual sampling events. The locations of the monitoring wells are shown on Figure 2.

The parameters being monitored include:

- Field parameters;
- Nitrogen as Nitrate;
- Total Dissolved Solids (TDS);
- Chloride;
- Dissolved Metals (Fe and Mn); and
- VOCs.

Sample containers will be prepared and provided by Columbia Analytical Services, Kelso, Washington. Samples will be preserved as per recommendations given in *Methods for Chemical Analysis of Water and Wastes,* USEPA-600/4-79-020 March 1983 or in *Standard Methods for the Examination of Water and Wastewater.* Table 1 summarizes USEPA-recommended containers, sample preservation, and holding times. The type and size of container used for each parameter and any preservative will be recorded on a Field Sampling Data sheet. Any deviations from Table 1 will be documented and noted with the results of sample analysis.

Groundwater elevations will be measured on a semiannual basis from the monitoring well network listed in Table 2. The network includes wells sampled for groundwater quality and those used only for measuring groundwater elevations. Each round of water level measurements will be obtained over a period not exceeding 8 hours. Depth-to-water will be measured with an electric water level probe or similar instrument, to the nearest 0.01 foot. The water level probe will be rinsed with distilled water before use in each well. All measurements will be taken from a marked surveyed point on the top of the well casing. Each measurement record will include the date, time, and initials of the operator.

4.5.2 Surface Water Monitoring

Monitoring of surface water will be performed at least once per quarter under the following conditions:

1. A grab sample (except for oil and grease), a time-proportionate sample, or a flow proportionate sample will be taken within the first hour after discharge begins. Time-proportionate and flow proportionate samples may be for a two hour period, but must be started within the first 30 minutes after discharge begins.

2. The sample will be taken as close to the point of discharge as reasonably practical and can be achieved safely.

3. The storm event must be at least 0.1 inches of rain in a 24-hour period.

4. The storm event sampled must be preceded by as least 24-hours of no measurable precipitation.

5. Sampling must be conducted to capture storm water with the greatest exposure to significant sources of pollution.

Samples will be collected at least once every quarter if the above conditions are met. If a qualifying storm event does not occur during the quarter, then a sample will not be collected and a Discharge Monitoring Report (DMR) will be submitted providing an explanation.

The following parameters should be monitored at the surface water detention pond outlet structure on a quarterly basis:

- Turbidity;
- Oil and Grease;
- pH;
- Biochemical oxygen demand;
- Total suspended solids;
- Ammonia;
- Alpha Terpineol;
- Benzoic Acid;
- P-Cresol;
- Phenol; and
- Zinc (Total).

4.5.3 Landfill Gas Monitoring

Due to the highly permeable nature of the surrounding site soils, landfill gas migration was detected at the eastern site boundary. In an attempt to mitigate this condition a perimeter gas collection system was installed in the late 1970's along the east and south property line. This system consists of a series of external wells connected to a flare by a header pipe. A large compressor is currently used to provide the vacuum on the wells for gas extraction.

Landfill gas is produced during the decomposition of refuse. The principal components of landfill gas are methane and carbon dioxide, which are generally present in approximately equal portions. Methane is combustible when present in concentrations of 5 to 15 percent by volume in air. Propane, butane, and ethane are sometimes found at trace levels in landfill gas.

Positive pressure develops within the interior of landfills due to refuse decomposition and subsequent gas production. This pressure becomes the driving force which pushes gas from the landfill into the atmosphere and/or surrounding native soils. To prevent landfill gas migration at Leichner Landfill, a landfill gas extraction/destruction system was installed. This system includes a landfill gas flare and over 90 gas extraction wells.

Gas control compliance guidelines were originally established under the Resource Conservation and Recovery Act (RCRA) of 1976. Gas control compliance is also required WAC 173-304, Minimum Functional Standards for Solid Waste Handling (MFS), Section 460(2)(6)(i)(A) and (B). Under both RCRA and the MFS, the following criteria apply:

- Methane concentrations at the property boundary shall not exceed 5 percent by volume (the lower explosive limit [LEL] for methane).
- Methane concentrations inside buildings and structures on landfills shall not exceed 25 percent of the LEL or 1.25 percent methane by volume.

In addition, the MFS also require that:

- Methane concentrations inside off-site structures shall not exceed one hundred parts-per-million (100 ppm). (WAC 173-304-460(2)(b)(i)(C)).

Fifty-one gas probes have been installed at Leichner Landfill (Figure 3). Probes are present along the perimeter of the landfill property boundary to monitor gas control compliance, and in areas within the property to more closely monitor the performance of the gas extraction system.

Parameters to be measured at the gas probes include static pressure and the concentration of oxygen and combustible gas.

Gas probes will be monitored monthly to assess regulatory compliance in terms of landfill gas migration. Site compliance is determined by the concentration of combustible gas (measured as methane) detected at the gas probes located along the property boundary.

Immediately following each probe monitoring session, the data will be evaluated and any needed corrective actions will be determined. Actions will be based on methane concentrations and pressure readings measured at the probes. If the methane concentration is below the MFS performance standard of 5 percent (by volume), the probes are in compliance and no action is necessary. However, at Leichner Landfill every attempt will be made to keep methane concentrations at zero at the property boundary. Concentrations greater than 5 percent (by volume) at the property boundary require notification and mitigating measures to correct the situation.

4.6 LEACHATE CONTROL

Where precipitation is high and/or the cover on landfills is poor (i.e. sparse or gravelly), infiltration of rain and surface waters occur. When the absorptive capacity of the refuse is exceeded, the excess water containing soluble substances exits the fill as leachate. Currently, the final cover incorporates a geomembrane to minimize the potential for infiltration. Semiannual monitoring of groundwater wells down gradient of the site is conducted to detect if any infiltration is occurring.

4.7 CONTROL OF NUISANCE AND HEALTH FACTORS

4.7.1 Noise

Noise levels of on-site equipment will be controlled by proper maintenance of mufflers. Other noises should not be detectable beyond the property boundary.

4.7.2 Unauthorized Access

Unauthorized access will be controlled by the existing fence and a lockable gate.

4.7.3 Fire

The vehicles, flare compressor housing, and maintenance facility will be equipped with suitable fire extinguishers for suppression of any minor fires and for personnel safety. Two Fire District No. 5 fire stations are located within 3 miles of the landfill.

4.7.4 First Aid

First Aid standards will be met by maintaining on-site first aid supplies and hygienic facilities, and by providing site personnel with mandatory first aid training (Multi-Media First Aid course taught by The American Red Cross).

4.7.5 Oxygen Deficiency

Oxygen deficiency is the direct result of poor ventilation in areas where the normal atmosphere is replaced by some other gas, or where the absorption, consumption, or biochemical depletion of the available oxygen results from the decomposition of organic matter. Oxygen deficiency commonly occurs in manholes and other poorly ventilated areas.

In any area of potential oxygen deficiency, a gas/oxygen deficiency detector (such as a "Gas Tech Methane/Oxygen Meter") should be used to sample and test conditions before any personnel enter the area. If less than 19.5% oxygen is detected, ample ventilation should be provided by using portable air blowers, or a self-contained breathing apparatus should be provided.

4.7.6 Toxic Gases and Vapors

Highly toxic gases and vapors may result from the decomposition of the refuse. A gas is a state of matter in which the molecular movement is almost unrestricted. A vapor is the gaseous phase of a substance that would commonly occur in a liquid form at normal temperature and pressure, such as water or gasoline vapor. A noxious gas is one that is directly or indirectly harmful to humans. A noxious gas could cause burns, explosions, asphyxiation, or poisoning. For example, methane is flammable and asphyxiating, but non-poisonous. Carbon monoxide, however, is non-combustible, asphyxiating, and poisonous. The gas detector discussed in the previous section should be used to check all enclosed areas prior to entry.

4.8 EMERGENCY PLANS AND PROCEDURES

Report all major problems and emergencies to Tom Eldred at Leichner Brothers Land Reclamation Corporation, telephone (360) 921-1692, Kim Hayes at EMCON, telephone (503) 819-7423, and Don Hullings at EMCON, telephone (503) 603-1063.

4.8.1 Fire

Personnel should be trained in the use of these extinguishers and should become familiar with their locations. The extinguishers should be inspected regularly by the fire department. In case of a major fire, all personnel should leave the area of the fire and notify Fire District No. 5. The gates should be closed to all but emergency vehicles.

4.8.2 Toxic Gases and Vapors and Oxygen Deficiency

Prior to entering manholes and other poorly ventilated areas, the ambient air conditions should be checked using a gas/oxygen deficiency meter. If gas or an oxygen deficiency is detected, the area should be well ventilated or a self-contained breathing apparatus should be provided. Personnel working in these areas must not smoke or use any equipment that could spark. They should always work in groups of two or more, with at least one person remaining outside in a well vented area at all times. These individuals must have a means for constant communication (voice or walkie-talkie) and should be connected together by a life line.

If the person(s) inside the enclosed area becomes affected by toxic gases or an oxygen deficiency, he should return to the open air, and first aid should be administered as needed. In life threatening situations, an emergency medical unit should be summoned immediately.

If toxic gases or vapors are encountered in open air conditions, all persons should move away from the area in the up-wind direction. Local emergency services and the appropriate agencies should be notified immediately. When the risk to human lives and public health has been mitigated, the source and cause of toxic gas emission should be surveyed by qualified individuals using appropriate safety procedures.

4.8.3 Explosions

If an explosion occurs, further explosions must be prevented by isolating the source of the explosion and any possible ignition sources. Anyone injured by the explosion should be removed from the immediate area and given first aid. The Fire District No. 5 should be contacted. The gates to the facility should be closed to all but emergency vehicles.

4.8.4 High Winds

Since tornadoes are not common in the Vancouver area, the most significant effect of high winds would be the toppling of trees and power poles. Caution should be exercised in areas potentially affected by falling trees or poles during high winds. Should a power pole be downed, the Clark County PUD should be notified immediately. Personnel should not work around grounded power lines.

4.8.5 Earthquakes

According to the Uniform Building Code, Leichner Brothers Landfill lies in Seismic Zone 3. The first priority is the preservation of life by responding to any life-threatening situations and providing first aid for anyone injured in the quake. Once the immediate action required to preserve lives is taken, all equipment should be shut down. Damages resulting from the earthquake must be assessed to determine any further necessary action.

4.8.6 Volcanic Eruptions

As was demonstrated by the 1980 eruption of Mt. St. Helens, the possibility of a volcanic eruption exists. If, as a result of an eruption, Leichner Brothers Landfill experiences an ash fallout, the operating equipment at the site could be severely affected. Large amounts of ash fallout could result in ash being drawn into the carburetor of the landfill equipment. This ash can be very abrasive and can seriously damage motors.

4.9 SITE INSPECTION AND MAINTENANCE

Surface drainage facilities, sedimentation and infiltration basins, vegetated soil cover areas, and on-site access will be inspected on a monthly basis and more frequently during periods of intense or prolonged rainfall. An inspection checklist will cover each of these items.

Any necessary repair will be accomplished in a timely manner. Temporary berms, ditches, straw mulch or other erosion control measures will be used as needed to prevent erosion damage of soil cover areas until weather conditions permit replacement of eroded soil and reseeding or alternative remedial measures.

4.10 CORRECTIVE ACTION PROGRAM

In the event that the surface water monitoring program or other indicators reveal a situation that warrants remediation, a corrective action program would be developed immediately.

Emergency actions to mitigate surface water contamination will include the following:

- Prevent storm water from discharging offsite and locate and eliminate contamination source;
- Temporary diversion and/or containment structures to prevent contaminated surface waters from being released offsite;
- Continuous observation to monitor performance of emergency structures and operations; and
- Collect contaminated surface water and reduce concentration levels of contaminants to acceptable levels prior to discharge.

Groundwater contamination and possible remedial actions were studied in a separate Remedial Investigation/Feasibility Study (RI/FS). The findings of the RI/FS were documented in reports dated February and April 1988, respectively. In the event that groundwater contamination is discovered, additional water quality samples will be obtained from established sampling locations and tested to verify contamination levels and to evaluate the lateral extent of contamination [173-304-490 (2) (i) and (j) and (3)]. Based on this information, a list of feasible long term corrective action alternatives will be developed and evaluated. A preferred alternative will then be selected, implemented and monitored to confirm successful remediation or to establish the need for additional clean-up.

5 POST CLOSURE

5.1 POST-CLOSURE LAND USE

The landfill is a broad elevated knoll. To minimize potential for damage to the geomembrane, no woody species plants are allowed to grow on the landfill. To minimize potential infiltration into the waste through the geomembrane, irrigation of any surface vegetation will not be practiced. Because of these severe restrictions, post closure land use should be limited to open space (e.g., walking trails, bike paths, etc.) or animal grazing.

Should other land uses be desired (e.g., golf courses, treed parks, building location, etc.) detailed engineering plans and modifications to the landfill cover should be developed to minimize adverse impacts on the cover which could negate the effectiveness of the cover as a moisture and gas barrier.

5.2 POST-CLOSURE MONITORING AND MAINTENANCE

Monitoring activities during post-closure will consist of inspecting the final cover for signs of failure (excessive settlement, erosion, geomembrane damage, etc.), checking the landfill gas monitoring probes on the landfill boundary, adjusting the active gas control system and flare, monitoring and evacuating gas condensate collection tanks, and sampling and testing groundwater to monitor the integrity of the landfill environmental controls.

The landfill cover will be inspected monthly and inspections will consist of walking the landfill surface and checking for:

1. Excessive and localized settlement;
2. Erosion rills on the cover soil;
3. Exposed geomembrane surfaces; and
4. Evidence of vegetative stress on and around the landfill.

Most settlement at the landfill has already occurred, but any localized settlement which could result in ponding or concentrated flows on the landfill will be repaired by placing additional soil fill in the depressions and regrading the area to a uniform surface. Once regraded, vegetation will be reestablished over the area. Any excessive settlement may be an indication of a landfill fire and will require proper notification (Section 4.8).

Erosion rills in the cover soil are generally caused by concentrated runoff directed to one location. Once erosion rills are discovered remedial action will be taken to repair the erosion. Should the erosion be noted during rainy weather, temporary measures will be taken to stabilize the erosion until permanent repairs can be implemented. These measures include constructing temporary berms and ditches to divert water; and placing straw mulch to trap sediment and reduce the velocity of flows through the eroded area. Permanent repairs will consist of inspecting the underlying geomembrane for damage, backfilling the erosion rill with compacted soil, regrading the tributary area to promote sheet flow and reseeding the repaired area to provide erosion resistant ground cover.

Should exposed geomembrane be noted during the inspection, the geomembrane will be carefully inspected for holes, tears or other damage. In the event membrane damage is found, the geomembrane will be repaired in compliance with manufacturer and site requirements. Once the membrane has been repaired, cover soil will be restored and the area regraded and seeded to minimize potential recurrence for exposure.

Vegetative stress noted on or around the landfill generally signifies oxygen depletion due to methane migration into the plant root zone. If stress is noted on the landfill surface the soil will be tested for methane using a portable gas meter. Should methane be detected, the cover soil will be carefully stripped from the distressed area and the geomembrane will be checked for punctures. Any punctures detected will be repaired immediately. If methane is not encountered, the soil in the distressed area will be sampled and then fertilized based on the laboratory test results.

If the vegetative stress is noted off the landfill, the stressed area will also be tested using a portable gas meter. Methane migration, if detected, will be mitigated by adjusting the flow of the nearest perimeter extraction well until methane is no longer detected in the distressed area.

In addition to inspecting the final cover on a monthly basis, the property boundary gas monitoring probes will also be tested. Should methane concentrations exceed 5 percent by volume, the nearest perimeter extraction well flow rate will be adjusted until the concentrations drop below 5 percent (Minimum Functional Standards (WAC 173-304).

The landfill gas condensate system will be checked weekly for proper operation. The sumps and air pumps will be checked for condensate build-up, air tube blockage, and any signs of abnormal operation. The holding tanks will be checked for condensate accumulation, and will be pumped if more than half-full. Condensate will be heat destroyed in accordance with local, state, and federal regulations. A chemical analysis of the condensate will be performed semiannually.

5.3 POST CLOSURE COSTS

Annual budgets will be prepared during post closure to estimate the cost of operations and maintenance of the Leichner Brothers Landfill. The annual post closure cost estimate will consider, at a minimum, the following:

- Changes in current site conditions;
- Condition and/or status of areas surrounding the site (e.g., increased residential developments surrounding the site may require increased site security);
- Revisions or updates to regulatory requirements;
- Increased maintenance and/or replacement of onsite equipment and structures;
- Compliance monitoring;
- Improvements in technology; and
- Inflation rates.

Funds for post closure and compliance monitoring have been established through Clark County to pay for all approved post closure costs in accordance with WAC 173-304-467.

TABLES

Table 1

Sample Containers, Preservation Methods, and Holding Times for Groundwater Samples

Leichner Landfill, Clark County, Washington

Parameter	Container	Preservation Method	Holding Time
Volatile Organic Compounds	40 ml glass; Teflon septum in cap	Cool to 4°C, fill with no headspace	14 days
Inorganics			
Chloride	500 ml poly	Cool to 4°C	28 days
Nitrate + Nitrite as Nitrogen	500 ml poly	Cool to 4°C, H_2SO_4 to pH <2	28 days
Nitrate as Nitrogen	500 ml poly	Cool to 4°C, H_2SO_4 to pH <2	48 hours
Solids, Total Dissolved	500 ml poly	Cool to 4°C	7 days
Metals, Dissolved	500 ml poly	Field filter, Cool to 4°C, HNO_3 to pH<2	6 months

Table 2
Groundwater Monitoring Schedule
Leichner Landfill, Clark County, Washington

Well Name	Aquifer	Water Levels		Water Quality
		Semiannual	Annual	
LB-1D	Troutdale	X	X	X
LB-1S	Alluvial	X	X	X
LB-3D	Troutdale	X	X	X
LB-3S	Alluvial	X	X	X
LB-4D	Troutdale	X	X	X
LB-4C	Alluvial		X	
LB-4S(R)	Alluvial	X	X	X
LB-5D	Troutdale	X	X	X
LB-5C	Alluvial		X	
LB-5S	Alluvial	X	X	X
LB-6S	Alluvial	X	X	X
LB-9S	Alluvial	X	X	
LB-10D	Troutdale	X	X	X
LB-10C	Alluvial		X	
LB-10S	Alluvial	X	X	X
LB-13D	Troutdale	X	X	X
LB-13C	Alluvial		X	
LB-13I	Alluvial	X	X	X
LB-14D	Troutdale	X	X	
LB-17D	Troutdale	X	X	X
LB-17C	Alluvial		X	
LB-17I	Alluvial	X	X	X
LB-17S	Alluvial		X	
LB-20S	Alluvial	X	X	X
LB-21D	Troutdale	X	X	
LB-21C	Alluvial		X	
LB-21S	Alluvial	X	X	
LB-22S	Alluvial	X	X	
LB-23S	Alluvial	X	X	
LB-24S	Alluvial	X	X	
LB-26D	Troutdale	X	X	X
LB-26I	Alluvial	X	X	X
LB-27D	Troutdale	X	X	X
LB-27I	Alluvial	X	X	X
MW-1 (E, N, S)	Alluvial		X	
MW-NE	Alluvial	X	X	
R-2	Alluvial		X	

FIGURES

NOTE:
NOT TO SCALE

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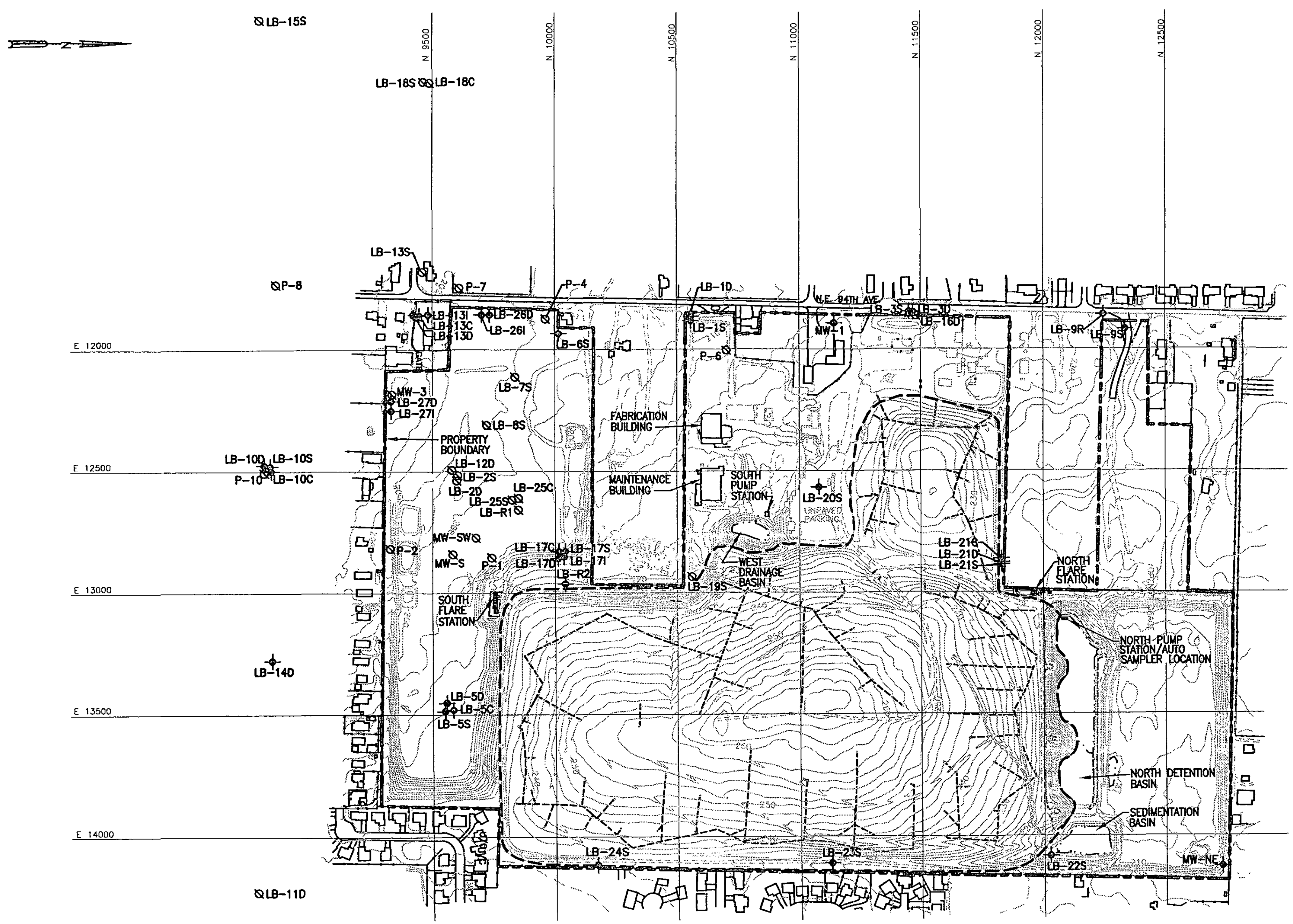
FIGURE 1
LEICHNER LANDFILL
VANCOUVER, WASHINGTON

SITE LOCATION MAP

Apr 22, 2005 - 3:28pm
N:\Cad\Drawings\Leichner Brothers LRC\2004 Master OPs Plan\822351-FIG-1.dwg

XREF Files: IMAGE Files:
File: N:\Cad\Drawings\Leichner Brothers LRC\2004 Master OPs Plan\822351-FIG-2.dwg Layout: Layout1 User: michael.kehano Apr 22, 2005 - 3:29pm



LEGEND:

- LB-13S,I,C Well Location, Alluvial Aquifer
- LB-13D Well Location, Troutdale Aquifer
- P-8 Abandoned Well or Piezometer
- Property Boundary
- Limit of Landfill Cover

NOTE: Topography from Walker and Associates. Photography dated: 19 May 1995.

SCALE

0 500 1000FEET

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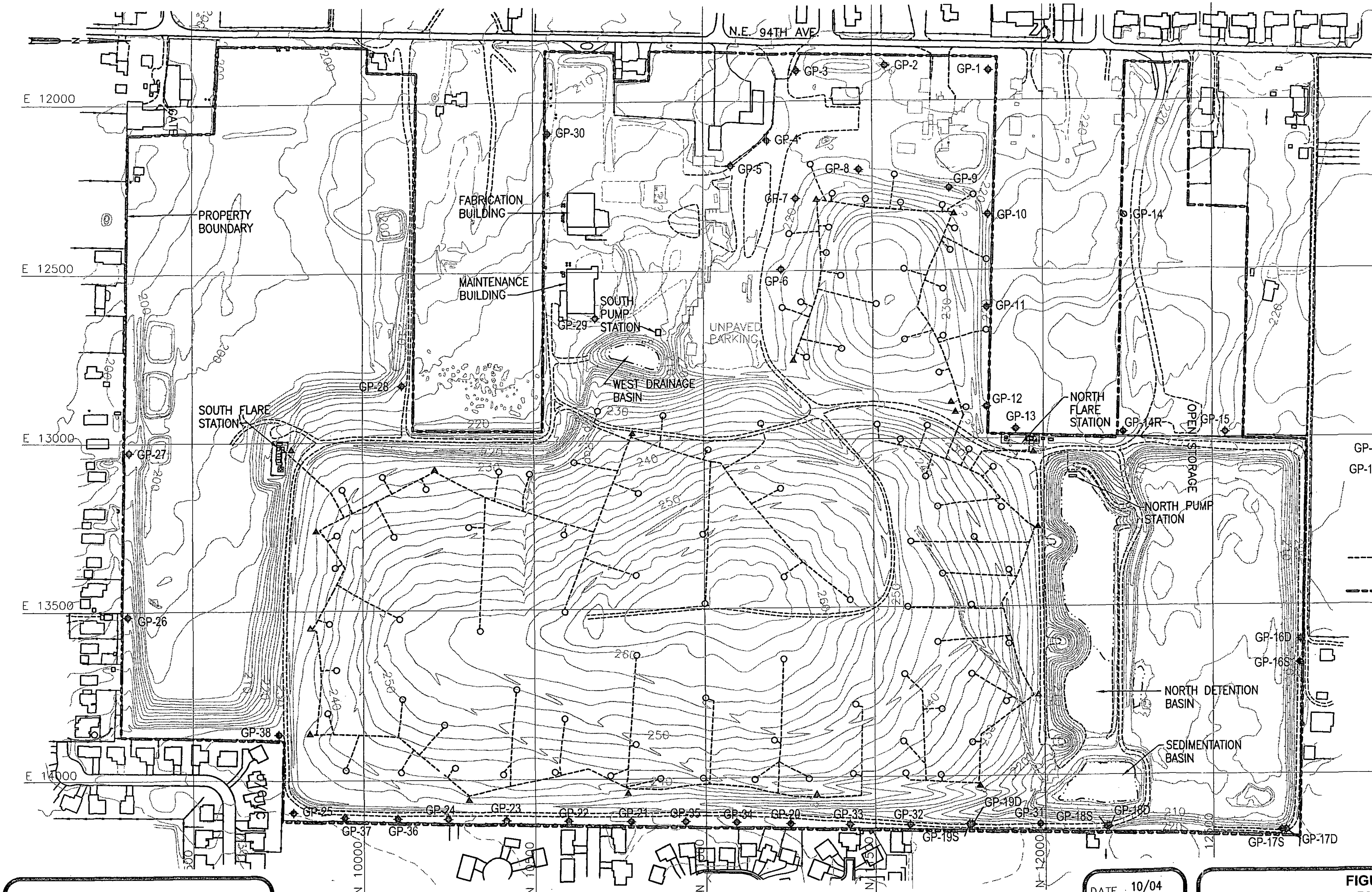
FIGURE 2
LEICHNER LANDFILL
CLARK COUNTY, WASHINGTON

MONITORING WELL LOCATIONS



LEGEND:

- GP-1 ◆ Gas Probe Location
- GP-14 ⊗ Decommissioned Gas Probe Location
- ○ Vertical Gas Well
- ▲ Condensate Sump
- Gas Collection Piping
- Property Boundary

NOTE: Topography from Walker and Associates. Photography dated: 19 May 1995.

SCALE

0 300 600 FEET

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FIGURE 3
LEICHNER LANDFILL
CLARK COUNTY, WASHINGTON

GAS PROBE LOCATIONS

Apr 25, 2005 – 10:07am
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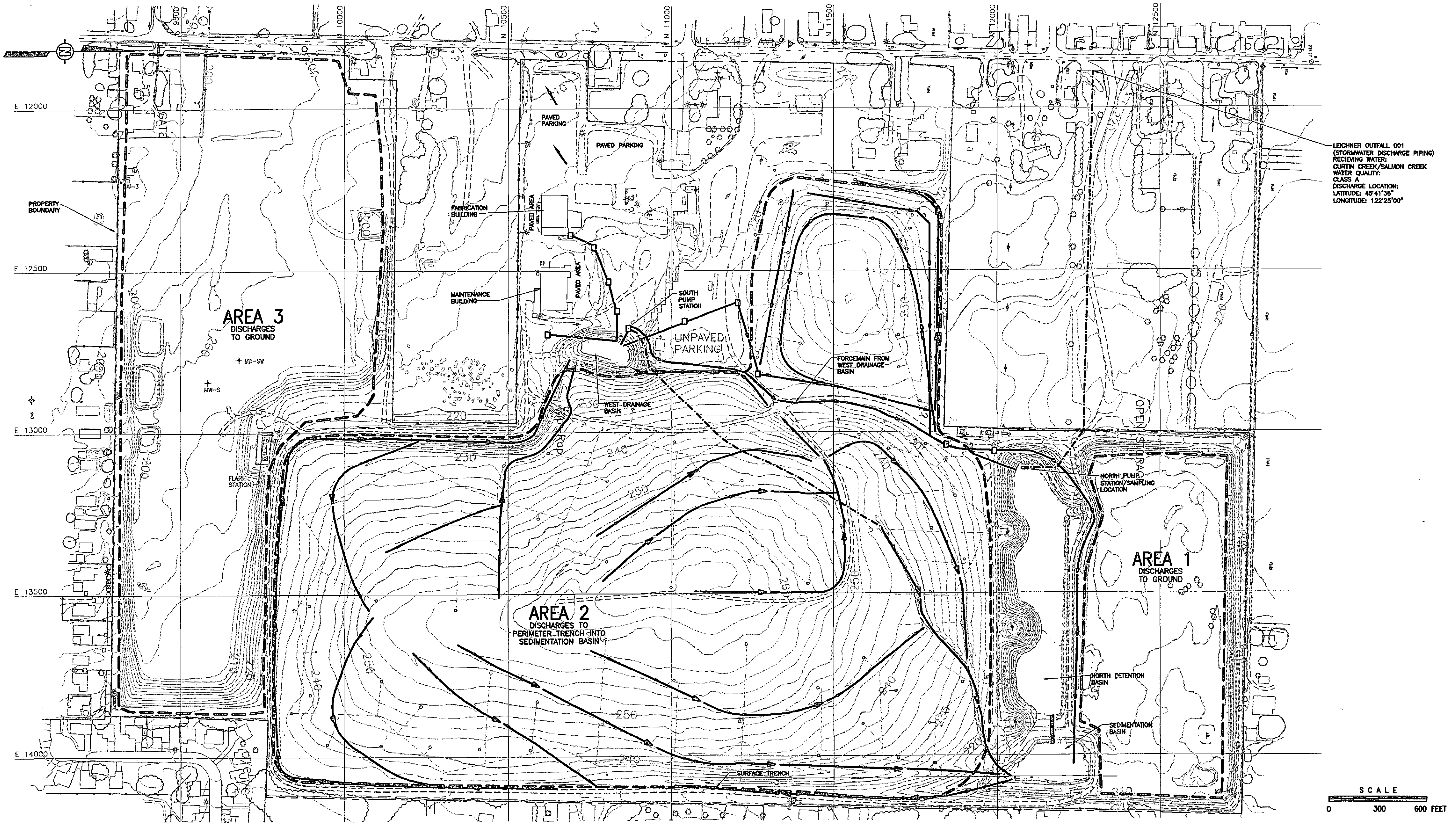

LEGEND:

- PROPERTY BOUNDARY
- DRAINAGE PATH
- UNDERGROUND STORMWATER COLLECTION PIPING
- STORMWATER COLLECTION BERM
- STORMWATER FORCEMAIN
- LIMIT OF LANDFILL
- CATCH BASIN

NOTES:

1. INDUSTRY LOCATION: 9411 NE 94TH AVENUE VANCOUVER, WA 98662

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FIGURE 4
LEICHNER LANDFILL
VANCOUVER, WASHINGTON

STORMWATER SYSTEM